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Supplementary Data

Facile and scalable fabrication of three-dimensional $Cu(OH)_2$ nanoporous nanorods for solid-state supercapacitors†

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Calculation methods

1. Three-electrode configuration

The areal capacitance C_a (F cm^{-2}) and gravimetric capacitance C_g (F g^{-1}) of the $Cu(OH)_2$ could be calculated from the corresponding cyclic voltammetry curve by the following equations:

$$C_a = \frac{\int I(V)dV}{2vS\Delta V} \quad (1)$$

$$C_g = \frac{\int I(V)dV}{2vm\Delta V} \quad (2)$$

where *I(V)* (A) is the response current, *V* (V) is the potential *vs.* SCE, *v* (V s^{-1}) is the scan rate, *S* (cm^2) is the effective area of the electrode, *m* (g) is the mass of the active material on the electrode, ΔV (V) is the working potential.

C_a (F cm^{-2}) and C_g (F g^{-1}) could also be calculated from the corresponding galvanostatic discharging curve using the following equations:

$$C_a = \frac{I\Delta t}{S\Delta V} \quad (3)$$

$$C_g = \frac{I\Delta t}{m\Delta V} \quad (4)$$

where *I* (A) is the discharging current, Δt (s) is the discharging time, *S* (cm^2) is the effective area of the electrode, *m* (g) is the mass of the active material on the electrode, ΔV (V) is the working potential.

The equivalent series resistance (R_{ESR}) (Ω) could be calculated by:

$$R_{ESR} = \frac{V_{drop}}{2I} \quad (5)$$

where V_{drop} (V) is the abrupt voltage drop at the beginning of the discharging curve, I (A) is the corresponding current.

2. Two-electrode system (asymmetric supercapacitor, denoted as ASC)

The specific capacitance C_{ASC} (F g^{-1}) of the ASC could be calculated from the corresponding galvanostatic discharging curve according to the following equation:

$$C_{ASC} = \frac{I\Delta t}{M\Delta V} \quad (6)$$

where I (A) is the discharging current, Δt (s) is the discharging time, ΔV (V) is the potential window during the discharging process, M (g) is the total mass of active materials in the ASC.

The energy density E (mWh cm^{-3}) and average power density P (mW cm^{-3}) could be calculated as:

$$E = \frac{\int V(t)dtI}{3.6Vol} \quad (7)$$

$$P = \frac{3600\,E}{t} \quad (8)$$

where $V(t)$ (V) is the potential of the ASC, t (s) is the corresponding discharging time, I (A) is the discharging current, Vol (cm^3) is the volume of the ASC including the volumes of two Cu foil current collectors and the gel electrolyte.

Supplementary Figures

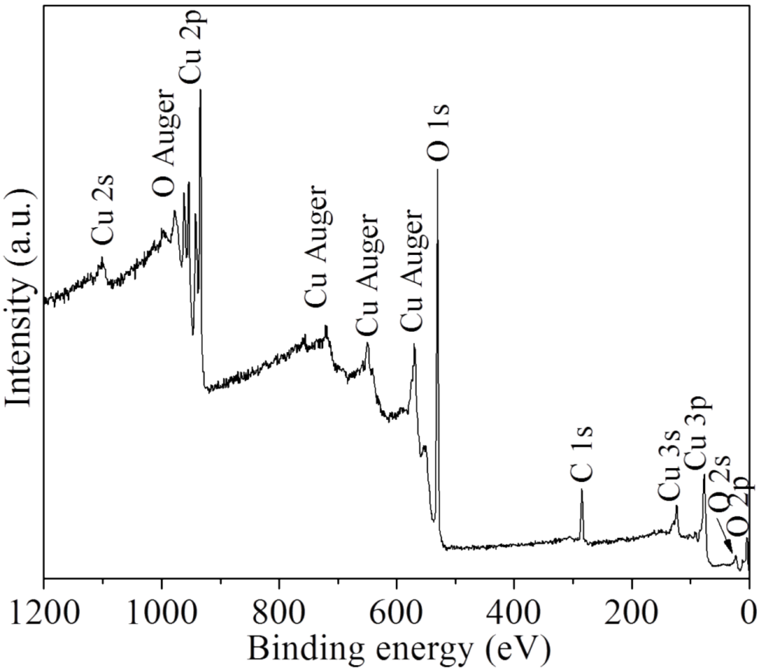

Fig. S1 Survey XPS spectrum of 3-D $Cu(OH)_2$.

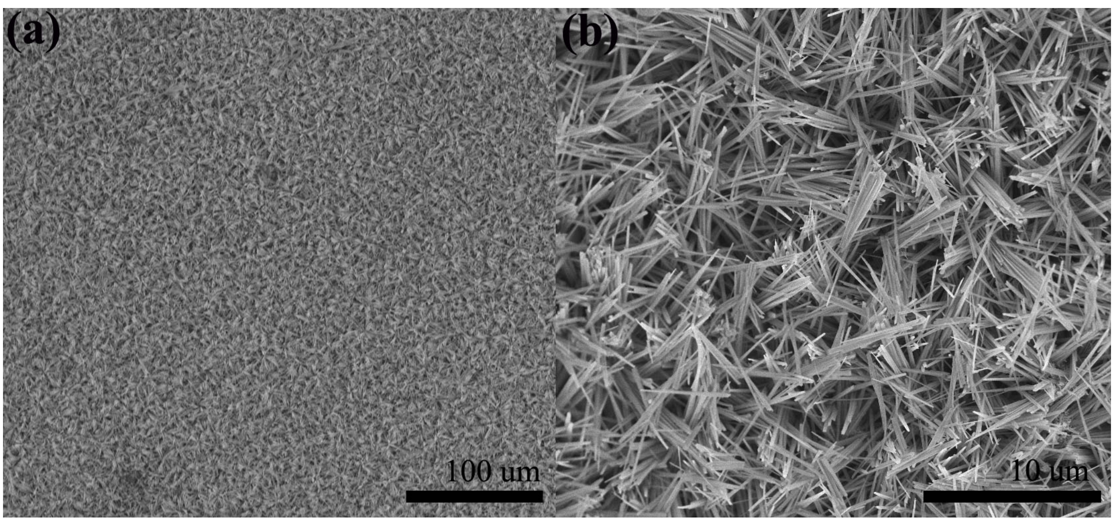

Fig. S2 (a,b) Low-magnification SEM images of 3-D $Cu(OH)_2$.

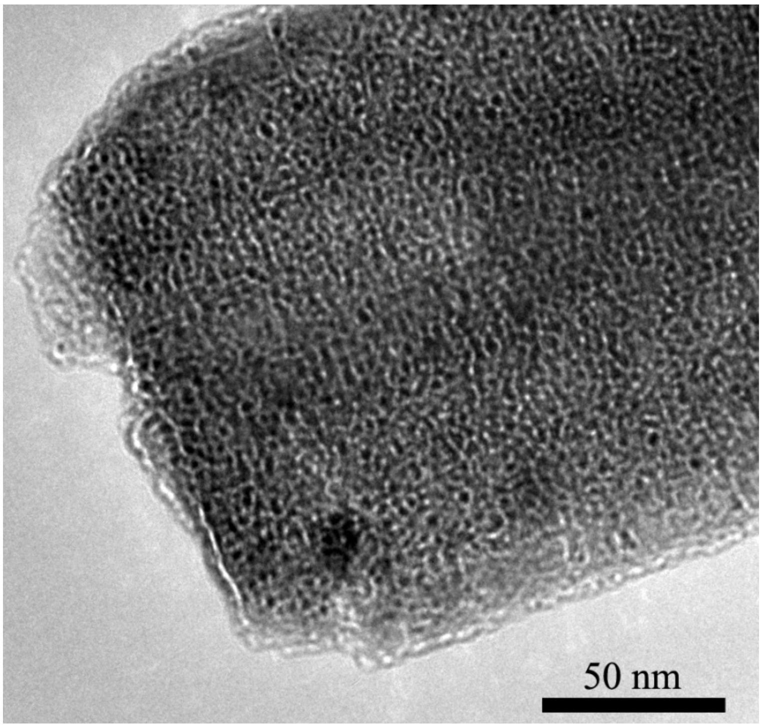

Fig. S3 Magnified TEM image of 3-D $Cu(OH)_2$ from Fig. 3d.

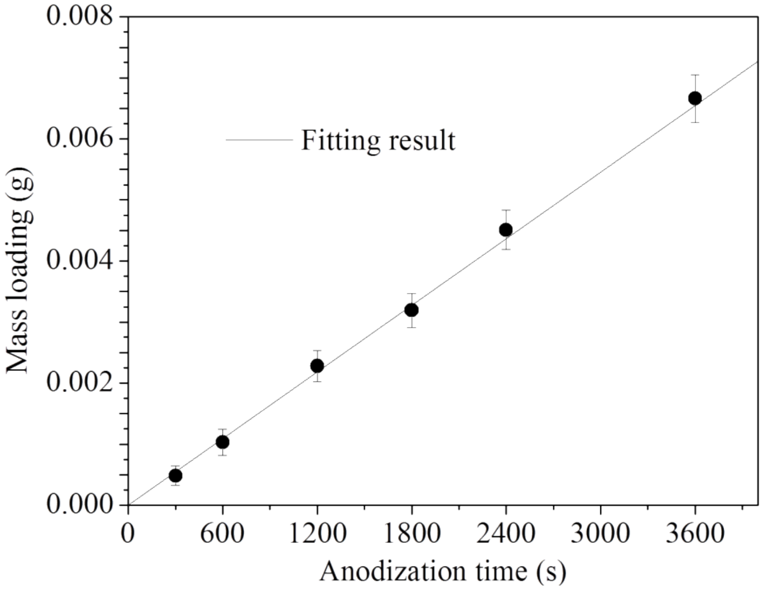

Fig. S4 Mass loading of $Cu(OH)_2$ on the 2×3 cm^2 $Cu(OH)_2$/Cu slice (2×2 cm^2 covered by $Cu(OH)_2$) with respect to different anodization time.

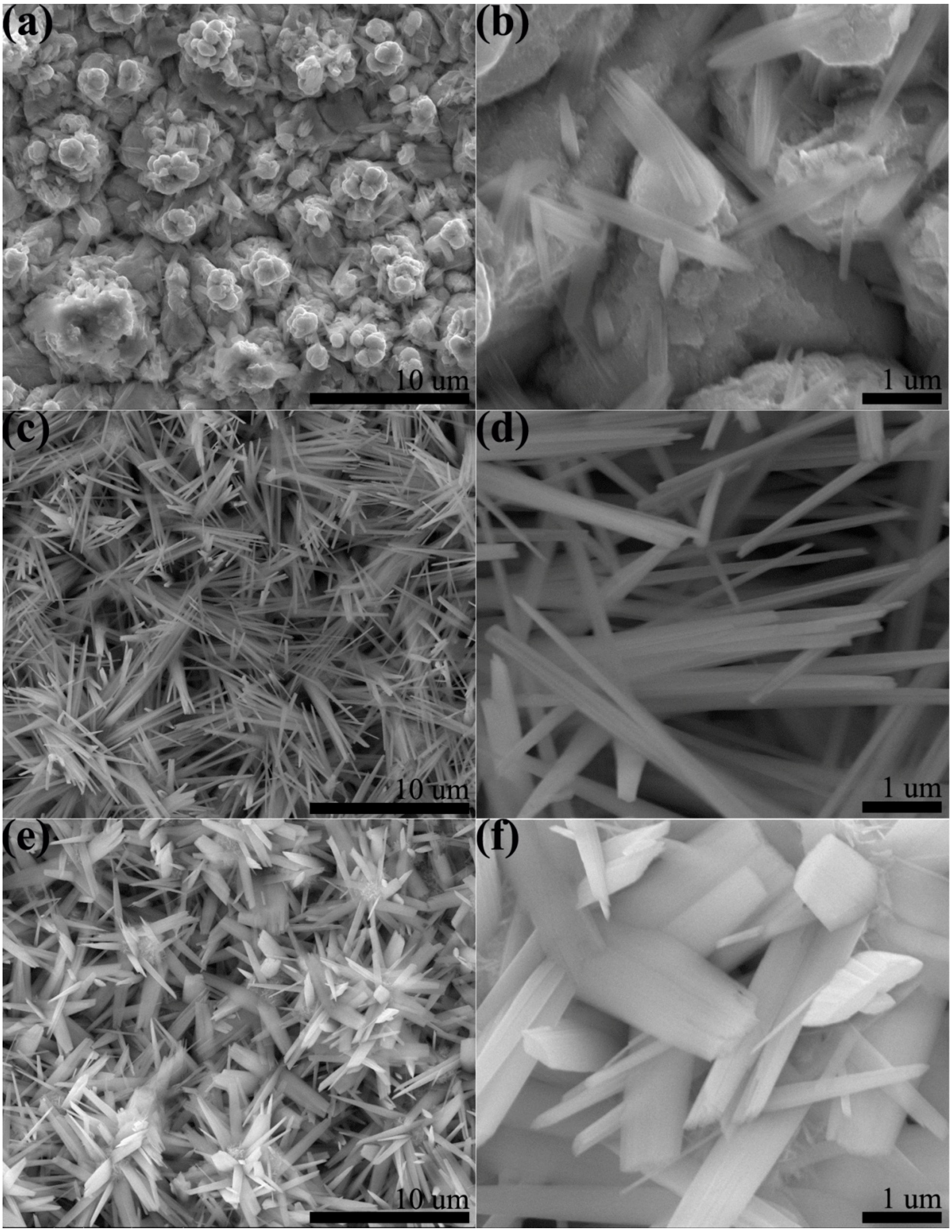

Fig. S5 SEM images of 3-D $Cu(OH)_2$ with respect to the different anodization time: (a, b) 100 s; (c, d) 1800 s; (e, f) 3600 s.

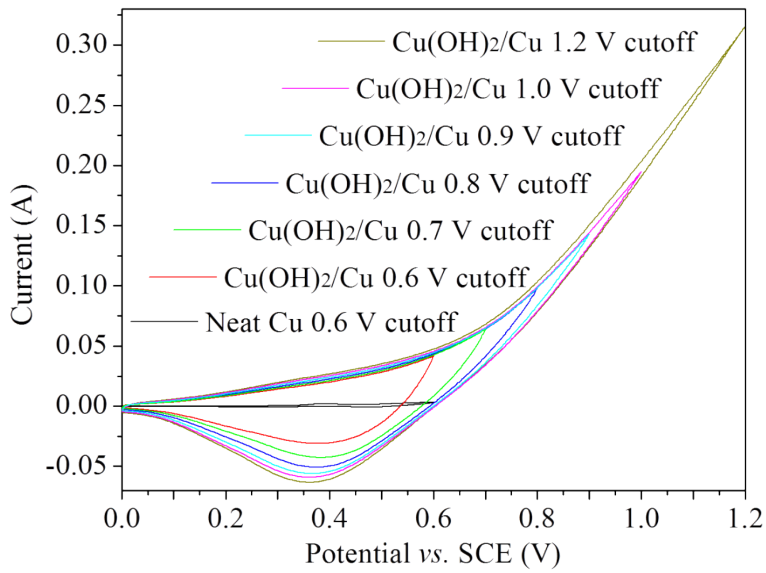

Fig. S6 CV curves of the neat Cu slice with a potential cutoff of 0.6 V at 50 mV s^{-1} and the $Cu(OH)_2$/Cu slice with potential cutoffs from 0.6 to 1.2 V at 50 mV s^{-1}.

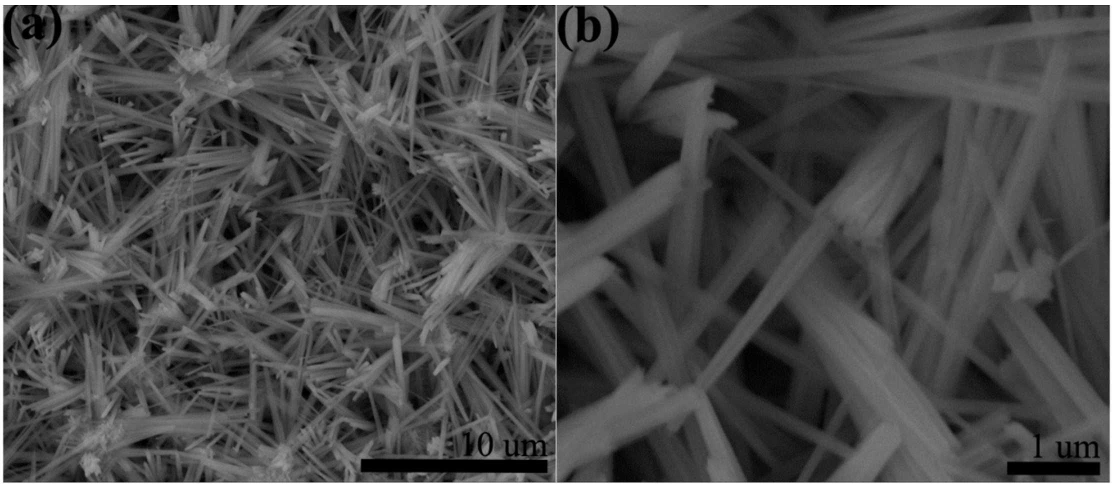

Fig. S7 (a,b) SEM images of 3-D $Cu(OH)_2$ after 5000 cycles.

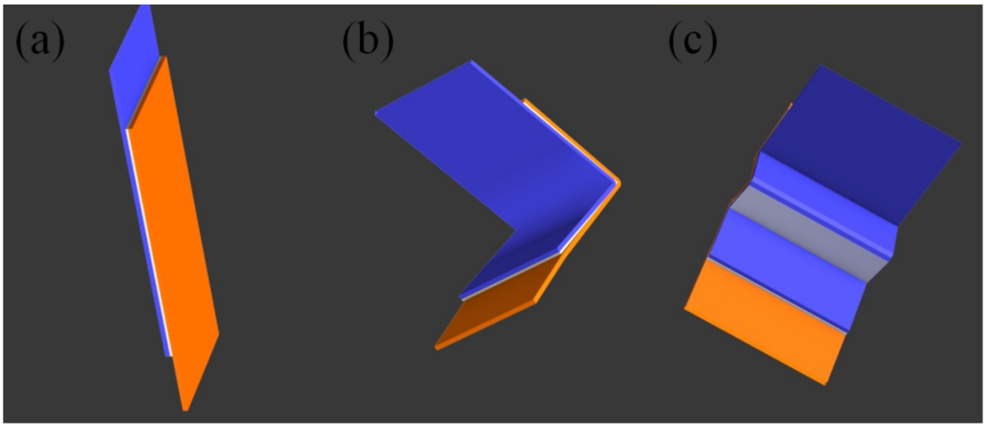

Fig. S8 Graphic illustrations of the $Cu(OH)_2$//AC solid-state ASC under (a) normal state, (b) bended by one fold and (c) bended by three folds.

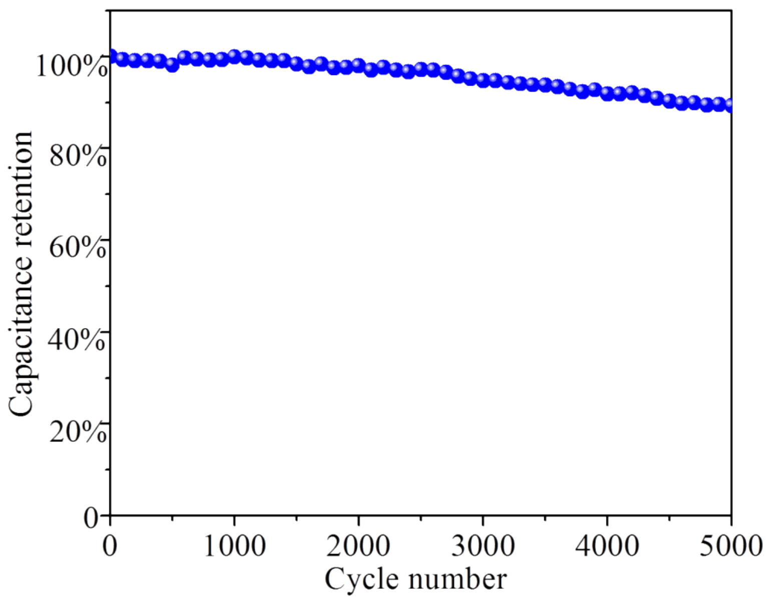

Fig. S9 Cycling performance of $Cu(OH)_2$//AC solid-state ASC at 10 A g^{-1}.

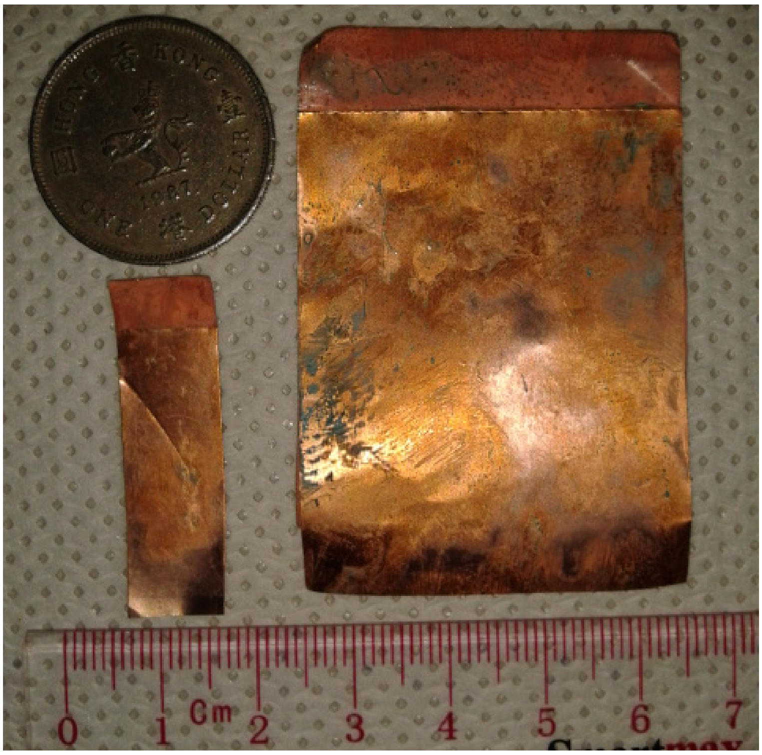

Fig. S10 Photographs of 1×4 cm^2 (left) and 4×6 cm^2 (right) $Cu(OH)_2$//AC solid-state ASCs.

Video S1 Demonstration of our tandem device (consisting of two 4×6 cm^2 solid-state ASCs) powering 26 LEDs.